ELECTRICAL CONNECTOR HAVING A HOLDDOWN FOR GROUND CONNECTION

This application claims priority to prior Japanese application JP 2003-48660, the disclosure of which is incorporated herein by reference.

Background of the Invention:

This invention relates to an electrical connector adapted to receive a thin card, such as an IC card, which is inserted into the electrical connector to be connected thereto.

An existing electrical connector of the type comprises a plurality of conductive contacts, an insulator holding the contacts, a conductive cover member attached to the insulator, and a plurality of conductive holddowns held by the insulator.

The insulator is adapted to be mounted on a printed circuit board. The insulator has a base portion and a pair of side wall portions standing up from the base portion. Each of the base portion and the side wall portions of the insulator has a thin flat-plate shape.

The cover member has a cover main plate portion having a flat plate shape and faced to the base portion of the insulator, a pair of cover side plate portions extending from opposite sides of the cover main plate portion to face outer surfaces of the side wall portions of the insulator, respectively, and a plurality of pressing spring portions formed on the cover side plate portions, respectively. The pressing spring portions are formed on the cover side plate portions in one-to-one correspondence to the holddowns.

Each of the holddowns has a holding portion held by each of the side wall portions of the insulator, and a connecting portion to be connected by soldering to a ground conductor portion formed on the printed circuit board.

The cover member and the ground conductor portion of the printed circuit board are connected through the holddowns by pressing the pressing spring portions to the holddowns. Each of the contacts has a terminal portion to be connected by soldering to a signal conductor portion of the printed circuit board.

As described above, the holddowns are pressed by the pressing spring portions of the cover member. Therefore, a whole of the insulator including the base portion and the side wall portions each of which has a thin flat-plate shape may be deformed under a load exerted by the pressing force.

In particular, the insulator made of a resin material and having a thin flat-plate shape is significantly decreased in rigidity if a reflow temperature for soldering is high.

In case where the insulator is pressed by the pressing spring portions and largely deformed, the flatness in arrangement of the terminal portions of the contacts is impaired. In this event, the terminal portions can not be soldered to the signal conductor portion formed on the printed circuit board. Thus, connection is unsuccessful when the electrical connector is mounted to the printed circuit board.

Japanese Patent Application Publication (JP-A) No. H8-171971 discloses an IC socket in which a seating member of a cover stopper formed on a socket body is soldered to a conductive pattern of a printed wiring board.

Japanese Patent Application Publication (JP-A) No. H09-289061 discloses an electrical connector in which a holddown for fixing a housing onto a circuit board is connected to a ground pattern of the circuit board.

Japanese Patent Application Publication (JP-A) No. H11-31556 discloses a PC card connector in which a cover is connected to a ground pattern of a mounting substrate.

However, none of the above-mentioned publications teaches a countermeasure for preventing the base portion and the side wall portions of a thin flat-plate shape from being deformed under the load by the pressing force of the pressing spring portions.

Summary of the Invention:

It is an object of this invention to provide an electrical connector in which a contact is reliably soldered to a ground conductor portion of a printed circuit board without deformation of an insulator and impairment in flatness of a contact array.

According to this invention, there is provided an electrical connector comprising a conductive contact, an insulator holding the contact and adapted to be mounted to a substrate, a conductive cover member held by the insulator, and a conductive holddown held by the insulator to connect the cover member and a ground conductor portion of the substrate, wherein:

the insulator has a base portion holding the contact and a side wall portion extending from the base portion;

the cover having a cover main plate portion faced to the base portion, a cover side plate portion extending from one side of the cover main plate portion to face an outer surface of the side wall portion, a first cover contacting portion formed on the cover main plate portion in the vicinity of the cover side plate portion, and a second cover contacting portion formed on the cover side plate portion;

at least one of the first and the second cover contacting portions having elastic restoring force;

the holddown having a holddown contacting portion extending across the side wall portion to the outside of the side wall portion to face the outer surface of the side wall portion;

the holddown contacting portion being located between the first and the second cover contacting portions and clamped by the first and the second cover contacting portions in a direction along the outer surface of the side wall portion.

Brief Description of the Drawing:

Fig. 1 is a perspective view of an electrical connector according to an embodiment of this invention;

Fig. 2 is an enlarged perspective and sectional view taken along a line 2-2 in Fig. 1;

Fig. 3 is an enlarged perspective view of the electrical connector without a cover member illustrated in Fig. 1;

Fig. 4 is an enlarged perspective view of the cover member illustrated in Fig. 1;

Fig. 5 is an enlarged perspective view of a holddown illustrated in Figs. 2 and 3; and

Fig. 6 is an enlarged perspective view of the holddown as seen from a rear side.

Description of the Preferred Embodiment:

Now, description will be made of an electrical connector according to an embodiment of this invention.

Referring to Figs. 1 through 3, the electrical connector comprises a plurality of conductive contacts 1 arranged in parallel to one another with a space left from one another, an insulator 3 holding the contacts 1, a cover member 5 integrally attached to the insulator 3, and a plurality of conductive holddowns 7 held by the insulator 3.

Each of the contacts 1 has a contact point portion 1a to be contacted with a card contact point portion of a card (not shown), and a terminal portion 1b extending outward from the insulator 3. The terminal portion 1b is connected to a signal conductor portion (not shown) of a substrate 21 by soldering.

The insulator 3 is mounted on the substrate 21, such as a printed circuit board. The insulator 3 has a thin-plate base portion 3a holding the contacts 1, and a pair of thin-plate side wall portions 3b extending from opposite sides of the base portion 3a parallel to each other. The side wall portions 3b are faced to each other on an inner surface of the base portion 3a.

The base portion 3a is provided with a first base opening 3c to allow the terminal portions 1b to be soldered to the substrate 21.

Although not shown in the figure, the insulator 3 has another side wall portion formed at a rear end in Fig. 1 and connected between the side wall portions 3b. The above-mentioned another side wall portion may be called a rear wall portion for convenience of description.

The cover member 5 covers the insulator 3. The insulator 3 and the cover member 5 are integrally coupled to form a housing as a whole. The cover member 5 is formed by press punching and bending a conductive metal plate.

As shown in Fig. 4 also, the cover member 5 has a flat-plate cover main plate portion 5a faced to the inner surface of the base portion 3a at a predetermined space, a pair of cover side plate portions 5b bent from opposite sides of the cover main plate portion 5a to face outer surfaces of the side wall portions 3b, respectively, and a cover rear plate portion 5c bent from a rear end of the cover main plate portion 5a to face the rear wall portion of the insulator 3 described above.

The cover member 5 has a plurality of first cover contacting portions 5d of a cantilevered shape and a plurality of second cover contacting portions 5e of a cantilevered shape. Each of the first cover contacting portions 5d extends

from the cover main plate portion 5a towards the cover side wall portion 5b.

Each of the first cover contacting portions 5d is formed by cutting a part of the cover main plate portion 5a and a part of the cover side plate portion 5b. Each of the second cover contacting portions 5e is formed by cutting a part of the cover side plate portion 5b in the vicinity of the first cover contacting portion 5d.

In a space between the inner surface of the base portion 3a of the insulator 3 and the cover main plate portion 5a of the cover member 5 faced thereto, the card is inserted in an insert direction depicted by an arrow A in Fig. 1. When the card is inserted into the space between the inner surface of the base portion 3a of the insulator 3 and the cover main plate portion 5a, the card contact point portion of the card is brought into contact with the contact point portion 1a formed at one end of the contact 1.

The cover side plate portions 5b of the cover member 5 are faced to the outer surfaces of the side wall portions 3b of the insulator 3. Each of the first cover contacting portions 5d has a base connected to the cover main plate portion 5a and has elastic restoring force. Each of the second cover contacting portions 5e has a base connected to the cover side plate portion 5b and has elastic restoring force.

As illustrated in Fig. 1, the cover member 5 in this embodiment is provided with the first and the second cover contacting portions 5d and 5e formed at four positions. The holddowns 7 are formed at four positions corresponding to the four positions of the first and the second cover contacting portions 5d and 5e, respectively.

Each of the holddowns 7 connects a ground conductor portion formed on the substrate 21 and the cover member 5. Each of the holddowns 7 is formed by press punching a conductive metal plate to produce a strip-like conductive metal plate and bending the strip-like conductive metal plate.

As illustrated in Figs. 5 and 6 also, the holddown 7 has a holding portion 7a disposed on the base portion 3a of the insulator 3 inside the side wall portion 3b, a holddown contacting portion 7b extending from the holding portion 7a across the side wall portion 3b of the insulator 3 to face the outer surface of the side wall portion 3b, and a connecting portion 7c to be connected to the ground conductor portion (not shown) of the substrate 21. The connecting portion 7c extends into a second base opening 3d formed in the base portion 3a.

The holding portion 7a of the holddown 7 is formed by insert molding simultaneously when the insulator 3 is molded, and is held by the insulator 3. When the base portion 3a of the insulator 3 is mounted to the substrate 21, the connecting portion 7c of the holddown 7 is connected to the ground conductor portion of the substrate 21 by soldering.

The holddown contacting portion 7b has a first contact point portion 7d contacted with the first cover contacting portion 5d and a second contact point portion 7e contacted with the second cover contacting portion 5e.

Thus, the holddown contacting portion 7b is located between the first and the second cover contacting portions 5d and 5e and clamped by the first and the second cover contacting portions 5d and 5e. The first cover contacting portion 5d has a free end having one plate surface pressed against the first contact point portion 7d on an upper end face of the holddown contacting portion 7b with elastic force, as illustrated in Fig. 2. The second cover contacting portion 5e has an end face (along a plate thickness) kept in contact with the second contact point portion 7e on a lower end face of the holddown contacting portion 7b.

Thus, the first contact point portion 7d is faced to and kept in contact with the free end of the first cover contacting portion 5d in a direction intersecting with the plate surface of the free end. The second contact point portion 7e is faced to and kept in contact with the end face of the second cover contacting portion

5e.

As mentioned above, the holddown contacting portion7b is clamped between the first and the second cover contacting portions 5d and 5e extending in directions generally perpendicular to each other. The holddown contacting portion 7b is kept in contact with the first and the second cover contacting portions 5d and 5e at the first and the second contact point portions 7d and 7e, respectively.

With the above-mentioned structure, the first and the second cover contacting portions 5d and 5e do not locally impose a pressing load upon the side wall portions 3b of the insulator 3. Therefore, no pressing load deforming the insulator 3 as a whole is applied.

The side wall portion 3b is provided with a step portion 3g formed on the outer surface thereof and kept in contact with a part of the end face of the second cover contacting portion 5e.

The electrical connector is assembled in the following manner. At first, the insulator 3 is formed by molding a resin material. At this time, the holding portion 7a of the holddown 7 is formed by insert molding together with the insulator 3 so that the holding portion 7a is held on the insulator 3. At the molding, a plurality of engaging protrusions 3f for fitting the cover 5 to the outer surfaces of the side wall portions 3b and the first and the second base openings 3c and 3d are formed.

A plurality of engaging holes 5f to be engaged with the engaging protrusions 3f are formed in the cover member 5. The cover member 5 is held by the insulator 3 by fitting and engaging the engaging protrusions 3f and the engaging holes 5f in one-to-one correspondence. Simultaneously, the free end of the first cover contacting portion 5d is brought into contact with the first contact point portion 7d of the holddown contacting portion 7b. The end face of the second cover contacting portion 5e is brought into contact with the second

contact point portion 7e of the holddown contacting portion 7b. Then, the holddown contacting portion 7b is clamped by the first and the second cover contacting portions 5d and 5e in a direction along the outer surface of the side wall portion 3b.

The electrical connector assembled as mentioned above is mounted on the substrate 21. At this time, the connecting portion 7c of the holddown 7 is soldered and connected to the ground conductor portion of the substrate 21. Then, the cover member 5 and the ground conductor portion of the substrate 21 are connected through the first cover contacting portion 5d, the holddown contacting portion 7b, the holding portion 7a, and the connecting portion 7c.

The first and the second cover contacting portions 5d and 5e are also formed at the rear end in Fig. 1. At the rear end of the electrical connector, each of the first cover contacting portions 5d extends from the cover main plate portion 5a towards the cover rear plate portion 5c. Each of the second cover contacting portions 5e is formed by cutting a part of the cover rear plate portion 5c in the vicinity of the first cover contacting portion 5d. In the manner similar to that mentioned above, the first and the second cover contacting portions 5d and 5e are kept in contact with the first and the second contact point portions 7d and 7e of the holddown contacting portion 7b of each of the holddowns 7 arranged at the rear end.

At least one of the first and the second cover contacting portions 5d and 5e has elasticity.

As described above, in the electrical connector according to this invention, the holddown contacting portion7b is located between the first and the second cover contacting portions 5d and 5e and clamped by the first and the second cover contacting portions 5d and 5e. Therefore, even if the cover member 5 and the ground conductor portion of the substrate 21 are connected with sufficient contact force, the insulator 3 is prevented from being deformed.

Therefore, the flatness in arrangement of the contacts 1 with respect to the signal conductor portion of the substrate 21 is not impaired and the contacts 1 can be soldered to the signal conductor portion with reliability.

While this invention has thus far been described in conjunction with the preferred embodiment thereof, it will be readily possible for those skilled in the art to put this invention into practice in various other manners.